

decomposition is a slow process and in 4-6 months forest fallow residues may yield no more than 30 to 50 per cent of the total potassium or calcium and magnesium, and 15-30 per cent of the total phosphorus, while the percentage release of nitrogen may be even smaller.

## TOBACCO RESEARCH BOARD OF SOUTHERN RHODESIA

### NEW HEADQUARTERS STATION AT KUTSAGA

By DR. F. A. STINSON

Director of Tobacco Research, Southern Rhodesia

TO solve the production problems of the expanding tobacco industry in Southern Rhodesia, the growers and Government jointly established in 1950 the Tobacco Research Board. Interest and confidence of growers in results of research have been considerable, owing to their representation on the Board and to the direct financial contribution they make toward it—more than £2 for every £1 provided from general taxation.

The Board's research approach is agronomic in its broad sense, and the investigations on crop rotations serve to illustrate this. Comprehensive rotation experiments were developed owing to the inadequacy of systems of cropping used on farms in all tobacco-growing areas. Their design permits comparing the effects, on yield and quality of tobacco, of growing many different crops in various sequences with a range of fertilizer practices, management and methods of crop disposal. Study of crop nutrition, soil organic matter and methods of disease, insect and eelworm control is also an integral part of these projects.

Experiments of lattice and factorial designs are used extensively to examine effects of inter-related production factors. Simultaneous examination of the important factors bearing on a specific problem has helped to minimize the dissipation of energy which would otherwise result if, in evaluating methods of controlling a leaf spot disease, for example, such important factors as date of planting, soil fertility and the effects of cropping systems on eelworm incidence were overlooked.

The excessive drainage and excellent aeration that make Rhodesian sandvelds so suitable for flue-cured tobacco pose special problems in humus replenishment and fertility maintenance. The abundance of available nutrients required for rapid growth and economic yields, along with the sensitivity of leaf quality to changes in nutrient balance, give nutritional research—both in the field and in the laboratory—a high priority in the programme. Present fertilizer investigations include examination of rates of use and sources of nitrogen, phosphorus, potassium and magnesium. Methods of fertilizer placement and the efficiency of nitrogen and potassium when applied fractionally, as well as responses to trace elements applied singly and in combinations, are being examined. Disease, insect and eelworm control investigations occupy an important place in the Board's work. Methods of producing tobacco seedlings, as well as cultural and curing practices, receive attention. The varietal improvement work includes testing and comparing the ability of particular varieties to produce high quality and yield, as well as evaluating their resistance to various

diseases and types of eelworm damage. Breeding work in progress is designed to introduce resistance or immunity while, at the same time, further improving the leaf qualities of those varieties now in common use for commercial production. By introducing improved varieties, materials and methods as standard treatment in all field experiments as soon as their superiority is indicated by research, such factors are proved on a farm scale before being offered to farmers in the form of recommendations.

The procedure in laying out field experiments has been standardized within the organization. Fields are divided into ranges and permanently bench-marked to accommodate 60-ft. rows of tobacco. Plots differ in width only; the number of rows per plot varies from one to eight, depending on the nature of the experiment. A permanent system of roadways and surface drainage is provided by placing the 60-ft. wide ranges 25 ft. apart, each intervening strip consisting of a broad-based terrace and a broad, shallow channel. The direction of ranges to field slope is adjusted so that the fall in the rows of tobacco and in the drainage channels ensures surface drainage without causing erosion. Ant-heaps up to 100 ft. in diameter and rock outcrops, common in Rhodesian tobacco-farming districts, complicate the siting of field experiments.

An important stage in the organization's development was marked by the formal opening of the Kutsaga Station on January 21 this year. This Station, which is near Salisbury, is now the headquarters of the Tobacco Research Board. Before Kutsaga was established, the Trelawney Station, opened by the Government in 1934 and leased to the Board in 1950, was the centre of tobacco research, and it will be operated in future as a branch station.

Kutsaga occupies 585 acres alongside the new national airport, ten miles south of the Federal capital. The research building provides spacious chemical and biological laboratories, a library, staff canteen and stores; the addition of two laboratory wings is anticipated. The laboratories are fitted with electricity, gas and hot and cold water. The Cape-Dutch design of the building blends with its natural surroundings of indigenous trees on a sandy slope typical of those in much of the tobacco-growing region. The slate roof, the teakwood terrazzo floor and the mukwa panels and fittings are in keeping with the importance of the country's largest industry which the Board serves. At the rear of the main building is a 100-ft. greenhouse and headhouse containing a laboratory and storage and potting room. Farm buildings for handling, curing and grading leaf from experimental plots were ready for the 1953-54 crop. Modern residences have been erected on the Station for key staff members, and substantial brick homes, with modern plumbing and sanitation, are being provided for all African employees and their families.

Staff are encouraged to obtain postgraduate experience outside Rhodesia, the Board's paid study-leave scheme being designed to facilitate this advanced training. There are also bursaries to assist above-average Rhodesian students to qualify at leading universities preparatory to employment by the Board. At present the Board has a professional staff of fifteen, including a biometrician.

The Board is aware of the importance of keeping the sponsors, especially tobacco growers, fully informed on the progress made. The frequent publication of reports of progress, bulletins and interim

reports, as well as the preparation of material for the Press and radio, is regarded as an integral part of the work. The new facilities at Kutsaga will contribute to progress in all branches of the present programme.

The land and buildings at the Kutsaga and the Trelawney Stations have permitted the development of research on most phases of tobacco production. More than four thousand plots were employed in the field experiments during the 1953-54 season. Lack of research information previously retarded development of Southern Rhodesia's flue-cured tobacco industry; but already the growers are extensively adopting with advantage the results of current research.

## INDUSTRIAL RESEARCH AND DEVELOPMENT IN THE UNITED STATES

A SURVEY of industrial research and development in the United States conducted in 1952 by the Research and Development Board of the Department of Defense has been issued by the United States Department of Labor\*. The report is based on a questionnaire sent to private companies and non-profit research agencies (excluding colleges and universities, as well as hospitals and museums). Some ninety-six thousand research engineers and scientific workers were employed in January 1952 by the two thousand companies which replied, and nearly 75 per cent of these were working for firms engaged in the aircraft, electrical machinery, chemicals and allied products, professional and scientific instruments, machinery (except electrical) and petroleum-refining industries, more than half being employed in the first three of these industrial groups. Two out of three engineers and scientists were on the staffs of companies with five thousand or more employees; but only 1.5 per cent of the employees of the reporting companies were research engineers or scientific workers. About half of them were working on federally financed projects, almost all of which were sponsored by the Department of Defense or the Atomic Energy Commission, and the number so employed was more than 50 per cent higher in January 1952 than in January 1951, although employment on company-financed research increased in most industries during the year. On an average there were 1.5 support workers (technicians and other laboratory assistants, clerical and administrative staff) per research engineer or scientist; but the ratio varied widely between companies and industries.

The annual turnover of this research staff during the year July 1950-June 1951 was 13.9 per cent, or about one-fifth higher than during the last half of 1951, when military service only affected about 3 per cent, although one-fourth of the research staff covered by the study were in the categories most liable to military service, 19 per cent were in the Reserves or National Guard, and another 6 per cent were classified 1A or 2A by Selective Service as of January 1952.

Expenditure of the reporting companies on research and development in 1951 was nearly 2,000 million dollars, compared with a national expenditure

on scientific and engineering research and development of about 3,750 million dollars, of which about 2,500 million dollars was for work done in laboratories and other facilities owned or operated by private industry. Of this 2,000 million dollars, more than 1,000 million was spent by the electrical machinery, aircraft and chemical industries, and nearly half of the 1951 research and development expenditure was provided by the Federal Government, ranging from 85 per cent in aircraft manufacture to 3 per cent in petroleum refining. Such research accounted for about three-fifths of the total in companies with less than five hundred employees, compared with about one-half for larger organizations. Research costs amounted to about two per cent of the total value of sales of the reporting companies in 1951, reaching 13 per cent in the aircraft industry but falling to less than 1 per cent in several others. The average cost per research scientist or engineer in 1951 was 21,900 dollars, being lowest in the chemicals and allied products industry and nearly four times as great in the motor-vehicle industry. Taking supporting workers into account, the average cost per research worker was 8,800 dollars, a ratio which varied much less among industries and companies than that for research scientists and engineers.

## CAMBRIDGE OBSERVATORIES

### REPORT FOR 1953

THE report of the Observatories Syndicate of the University of Cambridge for the year ending September 30, 1953, includes the following headings: reconstruction and re-equipment; solar research; stellar photometry; optics; other investigations; buildings and grounds; lectures; and published papers. The following are the more outstanding items in the report for which there is space in this short article to mention. After exhaustive tests by Drs. H. von Klüber and Z. Suemoto, the spectrograph in the new solar tunnel has been completed and put into use. The grating in the instrument, a modern one lent by the Mount Wilson Observatory primarily for the 1954 eclipse, has proved far superior in general optical quality to any other possessed by the Observatories. The installation of the new 17-24 in. Schmidt telescope which has replaced the Huggins refractor is almost complete, and the telescope is being tested and adjusted. Among the programmes of work proposed for this instrument, an immediate one is the examination and identification of radio sources. The construction of the new 36-in. reflector is continuing, and the firm of Sir Howard Grubb, Parsons and Co. estimates that delivery should take place this autumn.

Solar work is primarily concerned with the problem of the structure of the outer layers of the sun, and in the new solar tunnel Drs. von Klüber and Suemoto have applied a Fabry-Perot interferometer to the measurement of profiles of well-isolated Fraunhofer lines (in the wave-length region 6200-6400 Å.) between the centre of the solar disk and the limb, using a resolving power of about one million. Among other items mentioned, reference may be made to a solar camera of 6 in. aperture and 40 ft. focal length, weighing about 100 lb. with power supplies included, which has been designed by Drs. D. E. Blackwell and D. W. Dewhirst. It is intended to be carried by

\* Scientific Research and Development in American Industry: a Study of Manpower and Costs. Bulletin No. 1148 of the Bureau of Labor Statistics, U.S. Department of Labor. (Washington, D.C.: Government Printing Office, 1953.) 50 cents.